Predicting share price of energy companies: June-September 2009

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Abstract

Previously, we have revealed the presence of a reliable linear dependence between share prices of energy-related companies and the difference between CPI and core CPI: any change in share prices is transmitted into a proportional change in this difference two and half months later. The difference itself is characterized by sustainable trends reigning over seven to twenty-year intervals. As a result, the link between the share prices and the difference allows predicting the former over longer intervals. Since mid-2008, the previously observed trend has been undergoing a transition to a new trend. Accordingly, one may formulate two principal problems: "What is the dependence between share price and CPI during the transition?" and "When and how can one determine the properties of the new trend?" Currently available information on the CPI allows predicting the share prices between June and September 2009.

Key words: COP, CVX, DVN, HAL, XOM, prediction, share price, CPI

JEL classification: G1, D4, E3

Introduction

Kitov and Kitov (2009b) revealed the presence of a reliable linear dependence between share prices of energy-related companies (Exxon Mobile and ConocoPhillips) and the difference between CPI and core CPI. Essentially, any change in share prices is transmitted into a proportional change in this difference two and half months later. The difference itself is characterized by sustainable trends reigning over seven to twenty-year intervals. As a result, the link between the share prices and the difference allows predicting the former over longer intervals. Since mid-2008, the previously observed trend has been undergoing a transition to a new trend, which we predicted in 2007 (Kitov, Kitov, 2008). Accordingly, one may formulate two principal problems: "What is the dependence between share price and CPI during the transition?" and "When and how can one determine the properties of the new trend?" Currently available information on the CPI allows predicting the share prices between June and September 2009.

We have also estimated empirical coefficients of the linear relationship for five S&P 500 energy companies: ConocoPhillips, Chevron, Devon Energy, Halliburton, and Exxon Mobil (Kitov, Kitov, 2009c). In general, bigger companies reveal the same slope *B* between -5.5 and -6.0 for the period from 1999 to 2009. DVN showed a larger (in absolute terms) slope of -7.7, and HAL the smallest slope -3.5. This finding indicates that DVN is likely of a higher efficiency in converting oil price, i.e. *cCPI-CPI*, into the share price. HAL was and is a less efficient company in sense of usage of the rally in oil price since 2002.

The most recent trend likely found its end in 2008. Therefore, a period of transition to a new trend has started. This observation raises many questions about the properties of the transition period itself and the next trend in particular: Where does the old trend fade away? Is the transition period characterized by a (nonlinear?) relation different from (1)? When does the new trend emerge? Is it possible to estimate the slope of the new trend when the old trend disappears?

In this paper we give preliminary answers to some of the above questions. For any researcher, it is exciting to be inside an unfolding time history and be able to predict the short-term evolution of measured variables, especially if these variables are considered as fundamentally unpredictable ones. Something is at stake.

1. The model

Share prices (*sp*) of energy companies showed an excellent relation to the difference between core CPI (*cCPI*) and headline CPI (*CPI*) in the USA. We have studied five companies of different size: XOM, COP, CVX, DVN, and HAL. The principal result of our share price modelling is that the price is represented by a linear function of the difference:

$$sp(t\text{-}t_1) = A + B[cCPI(t) - CPI(t)] \quad (1)$$

where *A* and *B* are empirical constants, t_1 is the time lag of the CPI behind the change in the share price. The slope *B* is of particular importance because its absolute value depends on the rate of growth of the difference.

So, the pricing model (1) assumes the presence of a linear link between a share price and the difference between the core and headline CPI, with the former index excluding energy- related goods and services. The intuition behind the model is simple; a higher pricing power of goods and services associated with energy, and thus with energy companies, is expressed in a faster increase in corresponding index. In the first approximation, the deviation

between appropriate price indices is proportional to the ratio of pricing powers of related companies. However, one should be very careful in selecting appropriate indices: it was found that the index for energy itself does not explain the evolution of share prices of corresponding companies. The change in energy price influences the share prices through longer chains which include price reaction of many goods and services.

So far the pricing model (1) is worthless because these are the share prices what drive the CPI. (As shown in Section 2, the change in share prices of energy-related companies leads the CPI by two and a half months, i.e. t_1=2.5 months.) Therefore, the model can not work without the crucial observation of the presence of sustainable (linear or nonlinear) trends in the differences. This phenomenon was found and reported in (Kitov, Kitov, 2008; Kitov, Kitov, 2009ab). It allows the prediction of the evolution of the differences, and thus the deviation between prices for corresponding goods and services. Apparently, is the difference evolves along a long-term trend the share prices must follow the same trend according to (1).

So, there exist sustainable (linear and nonlinear) trends in the differences between various subcategories of consumer (and producer) price indices. We consider the sustainability as an equivalent to the possibility to describe such trends by simple functions of time. Figure 1 shows that the difference between the core CPI, *cCPI*, and the headline CPI, *CPI*, can be approximated by a simple time function:

$$dCPI(t) = a + bt \qquad (2)$$

where *dCPI(t)* is the difference, *a* and *b* are empirical constants, and *t* is the elapsed time. Between 1981 and 1999, the trend has a slope +0.67, and from 2002 to 2008 the slope is -1.62. Hence, the "distance" between the core CPI and the headline CPI is a linear function of time; with a positive or negative slope *b*. It might be of fundamental importance that absolute value of the ratio of slopes is inversely proportional to the ratio of durations: $\left|0.67/(-1.62)\right| \approx 7/19$. It such a trade-off actually exists one can predict the duration of the next trend from its slope. This observation needs a deeper investigation.

Initially, we used the seasonally adjusted (SA) consumer price indices (Kitov, Kitov, 2009b). The core and headline (SA) CPI difference explained well observed share prices. However, we had no intention to match fine details of predicted and observed curves – just peaks and troughs. In this paper we predict the share prices at short time horizons of several months. Accordingly, we carried out a small investigation and found that the not seasonally adjusted indices are superior to the adjusted ones in the share price prediction. Indeed, the SA indices contain information about prices for goods and services for five previous years. This information is irrelevant to current share prices and thus the prediction using (1) is biased. As before, we have retrieved all (monthly adjusted for dividends and splits) share prices from http://finance.yahoo.com and the CPI monthly readings from http://www.bls.gov/data/.

Empirical constants in (1) have to be determined for all distinct periods with different trends. This implies the possibility of structural breaks in relationship (1) caused by turns to new trends. In this study, we are focused on the most recent trend from 2002 to 2008 and the following transition period. So, empirical constants in (1) for the five companies were determined with a higher accuracy and thus may differ from those determined in our previous paper (Kitov, Kitov, 2009c).

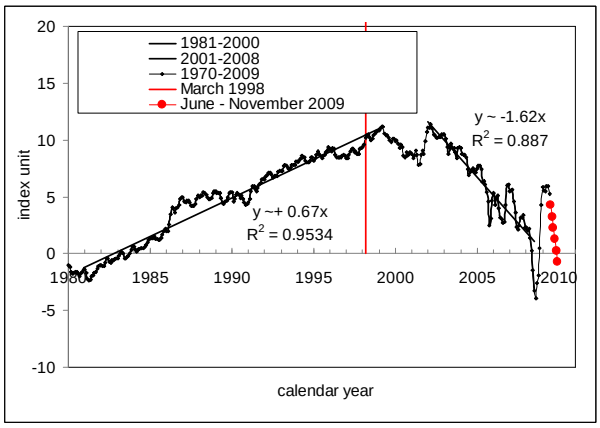

Figure 1. The difference between the not seasonally adjusted core CPI (*cCPI*) and the headline CPI (*CPI*) from 1980 to 2010. There are two distinct periods from 1981 to 1999 and from 2002 to 2008, where the growth in the difference can be accurately approximated by linear functions of time with slopes +0.67 and -1.62, respectively. Notice that absolute value of the ratio of slopes is inversely proportional to the ratio of durations: $|0.67/(-1.62)| \approx 7/19$. The prediction for the period between June and November 2009 is shown by red circles.

2. Predicting share price between June and September 2009

Relationship (1) implied a direct causality – the share prices affect the CPI and its components with some time lag, $t_1>0$. This direction of causality is obvious. As discussed in Section 1, one can also predict the evolution of share prices using (1) because of the presence of long-term sustainable trends. In other words, when a new trend emerges one can link given share prices to the evolution of *cCPI-CPI* over the whole period where the trend exists. Two previously observed periods were between 1982 and 1999 and between 2001 and 2009, i.e. 19 years and 8 years. So, when the slope of the most recent trend became clear one could forecast several years ahead. Moreover, since the trend was negative, a working assumption on the next turning point could be related to the intersection with the zero line. We used this assumption predicting the turn in the middle of 2008 (Kitov, Kitov, 2008).

It is likely that we are currently in the middle of a transition period and new trend has not emerged yet. To investigate principal properties of the transition process we begin with the illustration of the previous change in trend. Figure 2 displays the actual COP (monthly close, adjusted for splits and dividends) share price and that predicted according to (1) with empirical coefficients A=80 and B=-6.0 estimated for the period between April 1998 and May 2009. The observed and predicted share prices diverge before March 1998. The trend before 1998 is defined by empirical coefficients A=-8 and B=2.5. It is important that before 2000 the perdition obtained for the earlier period does not deviate much from that with the coefficients for the later period. Thus, one cannot distinguish between two sets of coefficients and the transition period has a dualistic properties – either of the two sets provides a good prediction. This answers the question about the relationship valid for the transition period – it is linear and does not differ from that for the evolution along trends.

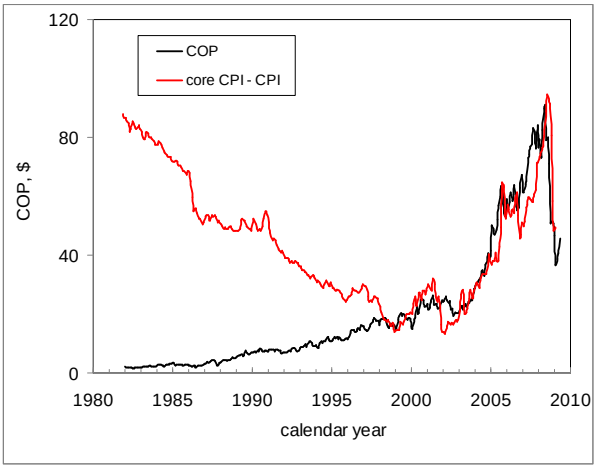

Figure 2. The transition between two periods with different constants *A* and *B* in relationship (1) in March 1998.

What are the properties of the *dCPI* during the transition period? Figure 1 depicts the difference between the core CPI and headline CPI between 1980 and 2010, with the vertical red line corresponding to March 1998. There was no dramatic change in the difference around 1998 except a slight increase in slope in the late 1997. It is possible that the transition period started in the late 1997 and lasted till 2000. Arbitrary, we have chosen relationship (1) with *A*=80 and *B*=-6.0 to reign since March 1998. All in all, one can conclude that the transition was not associated with any visible change in the behavior of the *cCPI-CPI* except the segment with a higher volatility between 1999 and 2001. Same behavior in expected during the current transition period – one can not distinguish between the old and new sets of coefficients in (1), but volatility in the difference and the share prices is high.

Having the pricing model (1) with preliminary empirical coefficient for the period between 2002 and 2008 for all five energy companies (Kitov, Kitov, 2009c), we are now interested in quantitative evaluation of the performance of (1) since July 2008. Another major task is to determine coefficients for the new trend and predict the share prices at a several months horizon using the difference *dCPI*. Figure 1 shows our best guess about the future of the difference. Solid red circles present a reasonable continuation of the quasi-sinusoidal oscillation started in January 2008. In July 2008, i.e. 6 months later, the oscillation reached its minimum and started a half period of quick growth. The difference reached its maximum in January 2009 and has been hovering around the peak since then. The first move down was recorded in May 2009. It is likely that the difference will be falling with acceleration during the next several months in order to close the full period and start a new one. Quantitatively, we presume that the difference will be decreasing by one init of index per month during the next 6 months, i.e. in will fall from 5.3 in May to -0.7 in November 2009. Considering the rate of growth in the second half of 2008, it seems to be a conservative estimate.

Figures 3 through 7 compare the observed share prices of the five companies and those obtained by trial-and-error method with visual fit using (1). All predicted curves, i.e. scaled *dCPI*, are shifted by 2.5 months ahead in order to synchronize them with the observed curves. This implies that share prices are converted into consumer prices with a delay of 2.5 months. Since the *dCPI* is extrapolated into the second half of 2009, we obtain the share price prediction for the period between June and September 2009. In turn, the share prices provide a prediction of the *dCPI* for the next two months.

Relationship (1) with coefficients *A*=75 and *B*=-5.5 describes the evolution of the ConocoPhillips share price between 1998 and 2009 relatively well, as Figure 3 depicts. The period after July 2008 deserves a special attention. The share price dropped from $91.0 to $37 in January. The difference followed the price up. After several months of the absence of any significant moves in the price, June 2009 may be the pivot point to growth. In May 2009, however, the price suffered a small decline instead of growth. Such and even bigger deviations were observed in the past as well.

If the *dCPI* will be decreasing according to its prediction in Figure 1, the COP price will rise to $79 in September. It is worth noting that one could obtain a better prediction for the period after 2007 using different coefficients *A* and *B*. However, the overall fit between 1998 and 2009 is a more important constraint for the pricing model.

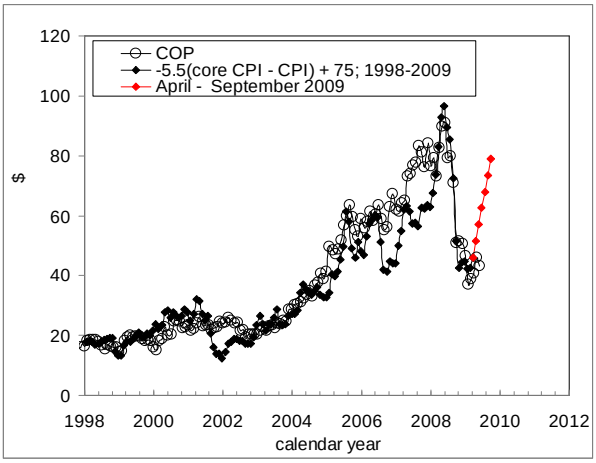

Figure 3. Observed and predicted COP share price. The predicted curve is shifted 2.5 months ahead in order to synchronize it with the observed one.

Figure 4 displays the observed and predicted share price for Chevron. Empirical coefficients were also estimated by matching the curves over the entire period shown in the Figure: *A*=83 and *B*=-5.5. Despite a good overall resemblance, the 2008 fall is overestimated - $50 instead of $60 close price in January. On the other hand, in line with our prediction Chevron demonstrates a positive price dynamics since January 2009. The months between June and September will be important for testing of the pricing model. Bearing in mind the linear trend in the *dCPI* between 2002 and 2008, the CVX model would be excellent if obtained in 2003.

The next company is Devon Energy Corporation, which showed the best performance between 1998 and 2009 in terms of "transmission" of the *dCPI* into share price (Kitov, Kitov, 2009c). In this study, we have corrected the previously estimated coefficients: *A* from 97 to 93, and *B* from -7.7 to -7.5. In spite of several sharp deviation between the observed and predicted curves (e.g. August-November 2006) DVN is the best modelled company among the five, as Figure 5 demonstrates. There is striking resemblance during the transition period. Moreover, the DVN share price has been on an upward trend since March 2009 as predicted by the *dCPI*. We expect this growth to stretch into the whole second half of 2009.

Figure 6 presents the case of Halliburton. Empirical coefficients, *A*=38 and *B*=-3.0, are slightly different from those obtained before. HAL share price has been growing at a lower (about a half) rate relative to other energy companies in this study. In other words, a one unit decrease in the *dCPI* was converted into $3 increase in HAL share price, when DVN

received a $7.5 increase. However, the pricing model for HAL is a robust one, especially after 2008. It accurately predicts the rise to $52.2 in May 2008, the drop to $16 in January 2009, and the start of a new rise in March 2009.

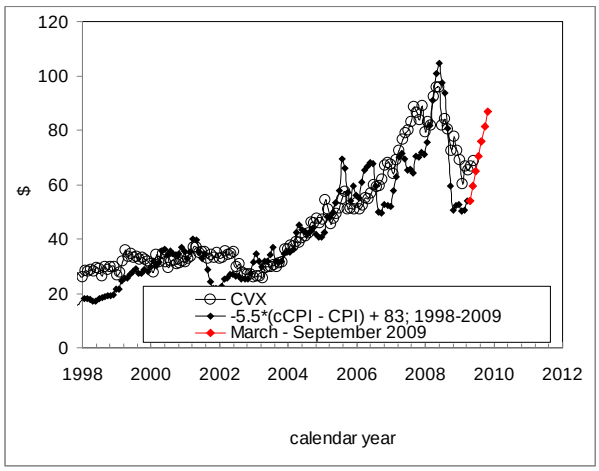

Figure 4. Observed and predicted CVX share price. The predicted curve is shifted 2.5 months ahead in order to synchronize it with the observed one.

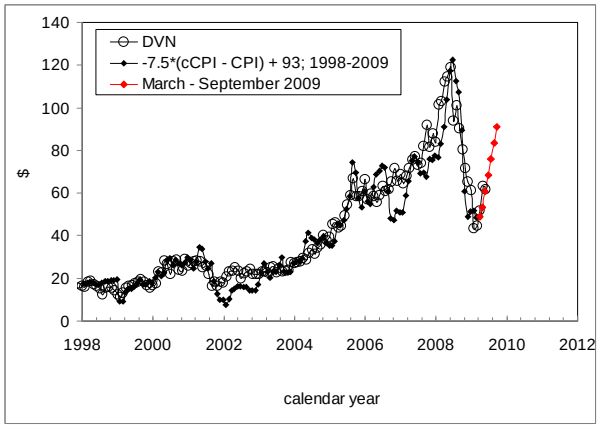

Figure 5. Observed and predicted DVN share price. The predicted curve is shifted 2.5 months ahead in order to synchronize it with the observed one.

Exxon Mobil is the biggest corporation comprising ~4.3% of the S&P 500 index. Therefore, one could expect that its share price might be less sensitive to short-term variations in the *dCPI*. Figure 7 supports this assumption. XOM share price showed much lower variations since 2008 than those predicted by the pricing model with A=90 and B=-6.0. Nevertheless, the long-term behavior is well predicted between 1998 and 2009. We expect the price to grow into September 2009.

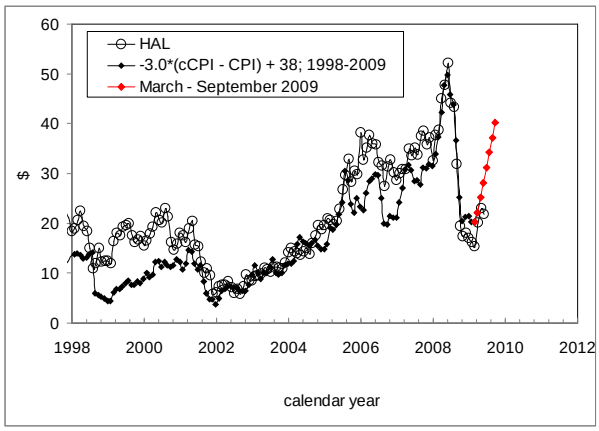

Figure 6. Observed and predicted HAL share price. The predicted curve is shifted 2.5 months ahead in order to synchronize it with the observed one.

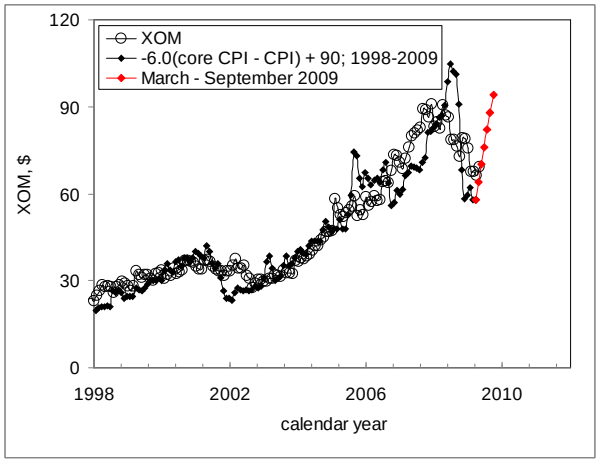

Figure 7. Observed and predicted XOM share price. The predicted curve is shifted 2.5 months ahead in order to synchronize it with the observed one.

Conclusion

These are preliminary findings:

- All share prices still obey (with varying accuracy) the empirical relationships obtained for the previous period.
- If the difference between the core and headline CPI will be decreasing between June and November 2009, the share prices will be proportionally growing, with the DVN share at most intensive rise.
- DVN has been demonstrating the highest effectiveness of the conversion of the *dCPI* into its share price. In 2008, this effectiveness had a slight negative effect – the deepest fall in the share price. Among all studied companies, the observed DVN price in the best modelled.
- XOM is the most conservative company. It had the smallest rise in price during the 2007-2008 rally and the smallest fall in 2008.

- The change in HAL share price leads that for other companies by 0.5 months. It might be of usage for short-term investors. However, the price has been falling with a slight overshoot in 2008-2009, i.e. below the level predicted by the pricing model. It might be an indication of the transition to the new relationship as well.
- CVX is also a reliable company with the price fell less than predicted.
- The predicted price of COP share fits the observed one over the entire period.
- Potentially one might be interested in finding a better pair of CPI components instead of the core and headline CPI in order to optimize the prediction.

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